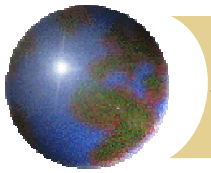


Evaluating Bulk Energy Storage to Relieve Transmission Congestion on the Island of Hawaii

DOE Energy Storage Systems Research
Annual Peer Review
November 19, 2002

Jonathan Hurwitch
Senior Vice President
Sentech, Inc.



Background

- ✚ Award from DOE's State Energy Program Special Projects solicitation for FY 2002

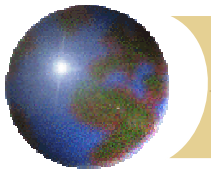
- ✚ Partners

 - Hawaii Electric Light Company (HELCO)

 - Hawaii Department of Business, Economic Development and Tourism

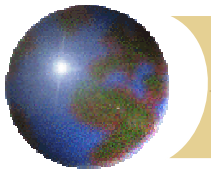
 - Sentech, Inc.





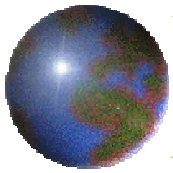
Purpose

- ✚ Evaluate the potential of energy storage to alleviate transmission congestion and delay expansion of the transmission grid as DER and renewable generation capacity is added



Big Island's Energy Situation

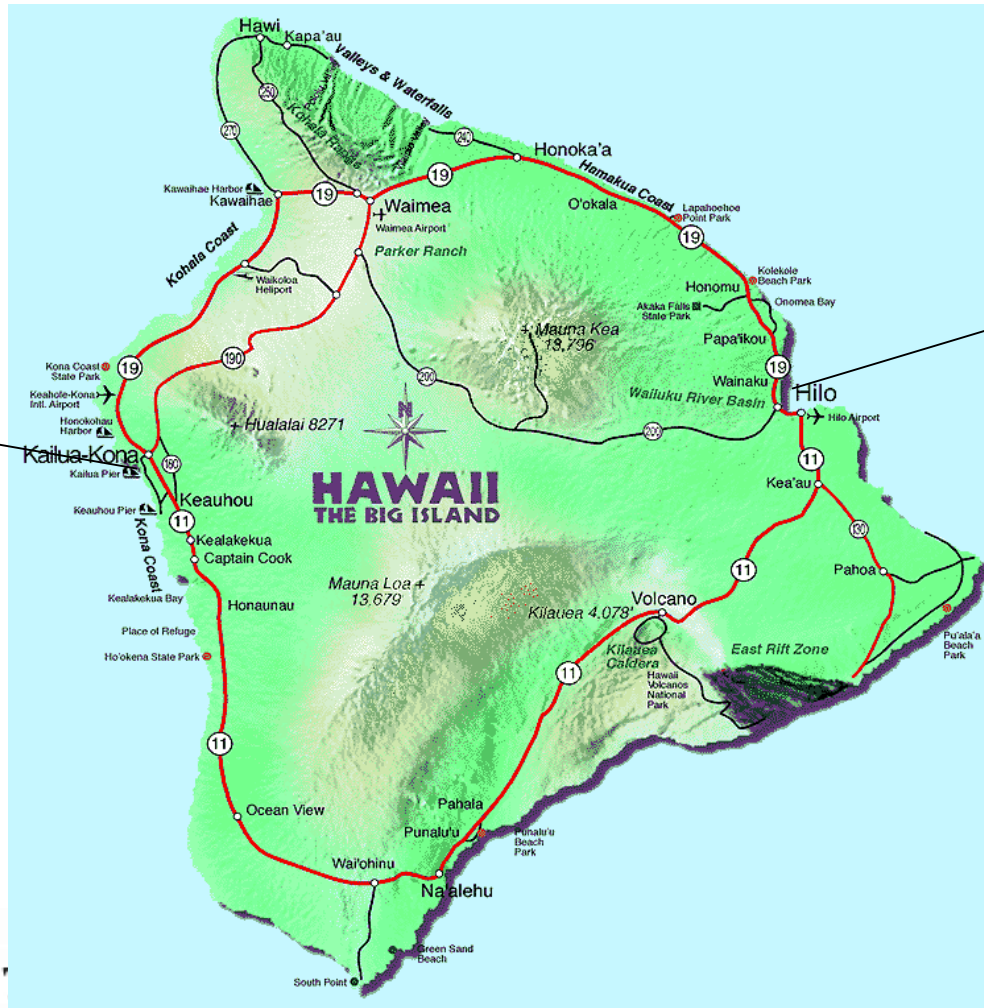
- ⊕ Rapid load growth on Kona Coast not located near generation in Hilo area
- ⊕ Transmission lines difficult to add for cost and aesthetic reasons
- ⊕ Large load fluctuations strain the grid
 - ⊞ Difficulty maintaining voltage and frequency
 - ⊞ Large area control error
 - ⊞ High losses

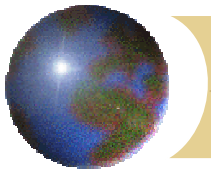


The Island of Hawaii

Kona

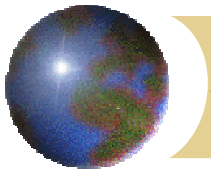
Hilo





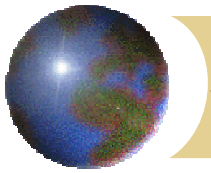
Task 1: Identify the Problems on Grid

- ❖ Identify existing power quality and transmission reliability problems
- ❖ Forecast electricity demand on island of Hawaii into next decade
- ❖ Project future power quality and transmission reliability problems
- ❖ Identify future electricity supply resources



Task 2: Identify Promising Technologies

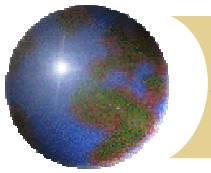
- ✚ Assess commercially available bulk energy storage technologies
- ✚ Document cost and performance parameters for these technologies



Task 2: Identify Promising Technologies

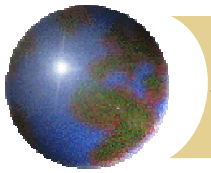
☼ Technologies to be considered:

- ☒ Regenesys
- ☒ Sodium-Sulfur Battery
- ☒ Nickel-Cadmium Battery
- ☒ Vanadium-Redox Battery
- ☒ Zinc-Bromine Battery
- ☒ Lead-Acid Battery
- ☒ Electrolyzer/Fuel Cell
- ☒ Pumped Hydro



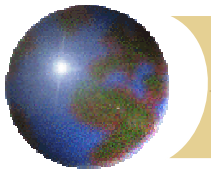
Task 3: Evaluate Impact of Technologies on the Grid

- ✚ Formulate realistic energy storage scenarios to be evaluated
- ✚ Model impact of energy storage scenarios on the HELCO grid using PSS/E and other modeling software



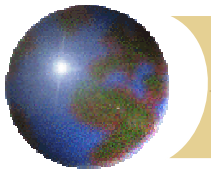
Task 4: Value Energy Storage

- ✚ Develop a business case for bulk energy storage on the Big Island
- ✚ Determine value of energy storage to HELCO based on scenarios developed
- ✚ Make recommendation regarding installation of bulk energy storage



Task 5: Project Increase in Renewables/DER with Energy Storage

- ✚ Energy storage could facilitate greater percentage of renewables and DER
- ✚ Estimate the additional non-dispatchable renewable and DER assets that could be accommodated on the HELCO system



Project Impact

- ✚ Evaluate the cost and impact of energy storage technologies in commercial situations
- ✚ Analyze issues that will increasingly be faced by other utilities as DER penetration increases